

## Functional Foods: Opportunities and Challenges for Developing Countries

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Functional foods have been the topic of considerable interest in the food and nutrition industry for years, but the term currently lacks a common definition.<sup>1</sup> A practical definition adopted here includes products, in food or drink form, that influence specific functions in the body and thereby offer benefits for health, well-being, or performance beyond their regular nutritional value.

These functional food products result from: technological innovation<sup>2</sup> at the processing level, such as cholesterol lowering spreads, xylitol-sweetened chewing gum, and dairy products fermented with specific lactic acid bacteria; technological innovation at the production level such as genetically modified crop seeds<sup>3</sup> (e.g., Golden rice) and planting materials derived through conventional breeding (e.g., orange-fleshed sweetpotato); or crops that naturally contain components that have a physiological function (e.g., soy bean and oats, which are good for cardio-vascular health). See Table 1 for examples.

### ECONOMIC OPPORTUNITIES FROM FUNCTIONAL FOODS

Functional foods entered the global markets with force in the past decade and rapidly gained market share conservatively estimated to exceed that for organic

foods. Thus, in addition to the health benefits, functional foods present new economic opportunities. Functional foods sell at higher prices and contain larger profit margins than conventional foods, which make the sector attractive for the players in the supply chain. Retail prices of functional foods are typically 30 to 500 percent above the comparable conventional foods. Confusion over the definition of functional foods makes it difficult to estimate the exact size of this sector—global market size has been estimated between US\$30 and US\$60 billion depending on the definition, with Japan, the United States, and Europe as the biggest markets. Regardless, the global functional foods sector grew exponentially over the past years with an approximately 10 percent annual increase in value. As a result, developing countries have started to emerge as exporters to cater to the increasing demand in the developed countries (see Box 1 for examples).

Moreover, demand for functional foods within the developing countries is growing, presenting a lucrative opportunity to develop domestic markets (see Box 2 for examples). The economic returns from functional foods can offer improved opportunities for all members in the supply chain: from raw material producers and processors to retailers.

Functional foods can be an opportunity for economic growth for many developing countries endowed with rich biodiversity and traditional knowledge of the health effects of certain indigenous plant species. Some developing countries can also be competitive in production due to lower labor costs (e.g., 10 percent lower soybean production cost in China's northeast region than in mid-west U.S. (Ford et al. Forthcoming)).

Besides the opportunity for diversified and high-value production, farming for the functional foods industry can benefit primary producers and rural communities in other ways. Poorer communities can benefit from growing functional food markets through domestication of wild plant species; enhanced links to the private sector, for example, through contract farming; employment or business opportunities from processing functional foods; and employment on plantations





**Table 1. Selected Examples of Functional Foods**

Functional Food	Benefit to Health and Well-being
Oats (beta-glucan)	Heart health
Eggs with increased omega-3 content achieved by altered chicken feed	Heart health
Margarine fortified with plant sterols	Improved cholesterol levels
Fermentation with specific bacteria to yield bioactive peptides	Lowers blood pressure
Chewing gum sweetened with xylitol instead of sugar	Helps prevent dental caries
Golden rice	Pro-vitamin A
Orange-fleshed sweetpotato	Pro-vitamin A

Source: Authors

(see Box 3 for examples). Moreover, some of the crops with health-enhancing features may be native to marginal areas, where more traditional farming is difficult and returns are low. Lastly, functional properties can increase the value of otherwise rare plant species, which can aid in biodiversity conservation if their sustainable use is carefully managed.

Still, relatively little is known about the current status of functional food production, products, and market development in most developing countries. A recent study (Kotilainen et al. 2006) sought to narrow this knowledge gap by reviewing the status of the functional foods sector through a literature review, in-depth studies of India and China, and an assessment of the sector in five countries—China, India, Brazil, Peru, and Russia.

### CHALLENGES AND SUCCESS FACTORS IN THE SECTOR

Even though developing countries are a rich source of raw materials for functional food products because of their vast biodiversity and cost advantages in crop production, developing a functional foods industry in these countries faces significant barriers. The cost of bringing a new product to the market can be significant,

especially the upfront costs associated with high-value food processing and exporting (search for markets, product research and certification, meeting regulatory demands, consumer research, and public relations).

Below are some of the major challenges and recommendations for how a country might tackle them.

**The regulatory framework.** Most countries lack a suitable regulatory category for these ‘hybrid’ functional food products, which makes market development much more complicated. A clear regulatory system for production, sales, certification, and advertising of functional foods, together with consistent enforcement are critical factors in building consumer trust in functional foods. A credible system can also help to provide a level playing field that fosters competition and encourages innovation. In many cases, development of institutional capacity is necessary. These institutions include food research centers, advisory services for producers, educators in food sector marketing and management, and authorities approving health claims for functional foods.

**The underlying science.** The development and marketing of functional foods require significant research efforts because most markets require scientific evidence

### Box 1. Emerging Functional Foods from Developing Countries

- **Brazil:** Manufacturers in Japan and the U.S. obtain plant-based physiologically active ingredients such as antioxidant compounds from acai-berry, guarana, and yacon.
- **Kenya:** There is a potential to develop the camel milk sector for the domestic market and to respond to the demand from South America. Camel milk has medicinal properties, especially in management of diseases such as diabetes, high blood pressure, heart disease, allergies, and peptic ulcers. Camel milk can be found in a number of supermarkets in Nairobi.
- **Peru:** Purple corn, yacon, maca, and cat’s claw are exported to Japan and the U.S. The export value of just two plants, purple corn and yacon, grew at an average annual rate of 467 percent and 335 percent, respectively, from 1998 to 2002. Dozens of companies are involved in export.

Source: EMBRAPA; BioTrade Peru 2004; Gitonga 2006; Authors.



## Box 2. Small but Growing Functional Food Market in Developing Countries

- **China:** The total functional foods market is approximately US\$6 billion per year, which is expected to double by 2010.
- **India:** With its strong tradition of eating healthy foods, India ranks among the top ten nations in buying functional foods and the market size is expected to nearly double in the next five years.
- **Brazil:** The sector is relatively young, growing rapidly and has significant room for further growth. Sales value is projected to reach US\$1.9 billion by 2009, which translates into a growth rate of 29 percent per capita spending on functional foods during this period.
- **Peru:** The sector for health foods, in general, is still in early stages, but has potential for growth because of rich biodiversity in roots and tubers containing diverse sugars and carbohydrates, which can respond to the demand for low-fat and sugar-free products.
- **Russia:** The value of functional foods market was estimated at US\$75 million in 2004, with an annual growth of 20 percent expected. The dairy industry took the lead in the functional foods movement and the largest growth is expected in this sector.

Source: Sun 2006; Ismail 2006; Benkouider 2005; Gutierrez 2004; Drujinina 2005; Spiridovitch 2005.

and proof of functionality. Even though certain foods may have been used for a long time for health-enhancement purposes, the definitive scientific support for claims as a functional product is often lacking. This involves identifying functional compounds and assessing their physiological effect, taking into account bioavailability in humans and potential changes during processing and food preparation and clinical trials on product efficacy in order to gain approval for health-enhancing marketing claims. This research requires time, financing, and skilled labor, especially for products destined for export markets. Lastly, innovation and research capacity is required to screen local biodiversity to uncover potential new sources for functional foods. This is also a management culture challenge for researchers because the best results can be obtained through partnerships between formal science institutions and indigenous communities.

**Understanding demand.** As implied above, the requirements of the market will define what regulations, actions, and science are needed in the producing/exporting country. This market information needs to permeate through the entire value chain of the product from producer to retailer. This would enable improved

strategic decision-making and better coordination and collaboration between the players in the supply chain. As market demand and the associated regulations differ in different markets, transaction costs in the export market are significant for individual companies. Specialized market development and export promotion services might offer a way to address this challenge. Moreover, policymakers need to concentrate on harmonizing regulations with those of major export markets to reduce potential trade barriers and unnecessary duplication of work for different markets.

Producers, processors, and retailers need to pay attention to both domestic and export markets. While in 2003, Japan, the United States, and Europe comprised 90 percent of global demand for functional foods (Datamonitor 2004), increased incomes in developing and transitional economies—especially China, Russia, and Brazil—currently feed a growing domestic market for functional foods.

**Understanding supply.** As mentioned before, developing countries often have a wealth of biodiversity to develop their functional foods sector. However, a sustainable management plan for these resources is

## Box 3. Peru: Farmers Gain in Cultivating and Processing Functional Products

The Asociación de Productores de Yacón de Oxapampa (APYEDO), a producers' association, with the assistance of the International Potato Center in 2002, started producing syrup, juice, marmalade, and dehydrated flakes utilizing yacón, which contains an oligofructose, utilized for low-caloric beverages and known to be beneficial for diabetic patients. Since 2003, several supermarkets in Peru have offered yacón syrup, juice, marmalade, and tea leaves. Although small-scale production predominates, exports of yacón products have reached markets in Japan, the European Union, and the U.S. High demand for information on yacón indicates that there is considerable interest in this crop in various parts of the world.

Source: International Potato Center (CIP) 2004.

important so as to avoid dramatic reductions in plant populations and interference in the dynamics of local biodiversity. On the regulatory level, it is also important to have intellectual property rights protection for new products developed in-country with equitable benefit-sharing between local communities and developers of the products.

Besides a well-defined regulatory framework, factors that enable a successful market for functional foods include: consumer awareness of health issues and their linkage to diets; consumer acceptance of food solutions to health issues; sufficient disposable income level; organized retail sector; and mature markets for processed foods.

## CONCLUSION

Developing countries can enjoy the benefits of the functional food sector to expand options for producers and to promote growth in the sector through partnerships between research centers, private entrepreneurs, and indigenous communities. However, the success requires sufficient proof to establish the health claim and capacity to accurately market functional foods to consumers in high-end markets. Countries that are interested in this sector should also assess the opportunities at the national level because functional foods cover such a broad group of products and production systems that some can find demand in the domestic market, while others can be targeted for export. Identification of specific export markets, certification and other regulations, and consumer demand are product and/or ingredient-specific, and largely dictate the possibilities for development. Further studies could establish the most critical bottlenecks in production systems and identify opportunities with the greatest potential for rural employment creation and competitive advantage for small-scale farmers as producers of functional foods.

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- <sup>1</sup> Functional foods fall in the grey area between conventional foods and medicine, which creates confusion in defining functional foods. This confusion permeates to all areas of production, processing, certification, and market development. Typically, the distinction is based on intended use: *Products that are used to treat or prevent a condition are considered medicine, while those used to improve health and reduce a risk of developing a disease could be classified as functional foods if they are presented in the form of food or drink, and meet other safety and quality conditions set for this category.* Distinguishing functional foods from dietary supplements and natural or herbal medicine is especially difficult, and cultural perceptions on this vary. Further complications are the large number of terms often used interchangeably and in a confusing manner such as health foods, nutraceuticals, designer foods, pharma-foods, and so forth.
- <sup>2</sup> Much of the basic fortification (such as iodization of table salt) is no longer considered "functional food" but new specialized extracts and ingredients for functional food fortification have emerged, including dietary fibers, plant stanols, and sterols and probiotics.
- <sup>3</sup> There is growing research on the potential of biotechnology to develop functional foods for improved health effects of the staple foods in developing countries—for example, high-iron rice, high-vitamin A rice, improved oil content in oil crops, and improved protein content in legumes (Niba, 2003). To date, none of these genetically modified products have reached large-scale production.

This note is based on Agriculture and Rural Development Discussion Paper 30, entitled "Health Enhancing Foods: Opportunities for Strengthening the Sector in Developing Countries," written by Liisa Kotilainen, Riikka Rajalahti, Catherine Ragasa, and Eija Pehu. The text of the report and this note can be downloaded at [www.worldbank.org/rural](http://www.worldbank.org/rural) or email [ard@worldbank.org](mailto:ard@worldbank.org).

